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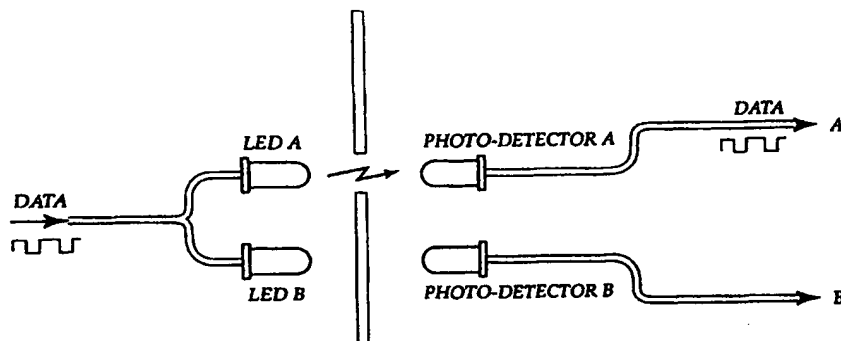
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(54) Title: DATA SWITCH



(57) Abstract

A data switch uses a movable apertured shutter to selectively allow communication between pairs of light emitting diodes and photodetectors.

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"DATA SWITCH"TECHNICAL FIELD

5 This invention relates to a data switch.

The data switch has particular utility in selectively routing data from a single user interface (eg. keyboard) to one of two or more independent data processing systems, each data system having a different  
10 security classification.

BACKGROUND ART

Data switches for selectively routing data from a  
15 single origin to one of two or more destinations are known. A data switch can also be used to selectively direct data from one of two or more origins to a single destination.

The present invention aims to provide an alternative  
20 data switch having advantages over known data switches.

DISCLOSURE OF INVENTION

In one aspect this invention resides broadly in a  
25 method of switching data, the method including selectively allowing and/or preventing communication between one or more data transmitters and one or more data receivers.

In one form, one (or more) transmitters can be  
30 selectively switched between two (or more) receivers. In a second form, two (or more) transmitters can be selectively switched between one (or more) receivers.

In another aspect the invention resides in a data switch including:-

35 one or more data transmitters;  
two or more data receivers;

wherein, in a first configuration of the data switch, a first data receiver receives data, and wherein,

in a second configuration of the data switch, a second data receiver receives data.

Preferably, the data switch is configured such that the two or more data receivers cannot simultaneously  
5 receive data.

In another aspect the invention resides in a data switch including:-

one or more data transmitters;

two or more data receivers;

10 one or more reception prevention means adapted to selectively prevent reception by at least one of the at least two data receivers.

In the preferred embodiments, the one or more data transmitters are light-emitting diodes and the two or  
15 more data receivers are photo-detectors, and each of the one or more reception prevention means is a light impermeable shield which is, in operation, interposed between a light-emitting diode and a photo-detector.

Preferably, the light impermeable shield is  
20 configured such that the two or more data receivers cannot simultaneously receive data.

In other embodiments, non-visible parts of the electromagnetic spectrum could be used to "carry" the data. Similarly, the reception prevention means may take  
25 other known forms (mechanical or non-mechanical) capable of blocking the transmission of data. However, for reasons of reliability, visible confirmation of operation and fail-safe robustness, it is preferred that the reception prevention means is a mechanical shield and the  
30 transmitters and receivers are light-emitting diodes and photo-detectors, respectively.

In preferred embodiments, each of the one or more reception prevention means is movable between a first position whereat it prevents reception by a first data  
35 receiver, and a second position whereat it prevents reception by a second data receiver.

In a narrower aspect, the invention, in one embodiment, resides in a data switch including:-

a pair of light-emitting diodes electrically connected to a common electrical input, each light-emitting diode adapted to convert an electrical signal from the common electrical input to light;

5 a photo-detector associated with each light-emitting diode for re-converting light emitted by an associated light-emitting diode to an electrical signal;

an apertured shutter disposed between the respective light-emitting diodes and photo-detectors, the apertured shutter being movable between a first indexed position whereat the aperture is aligned with a first light emitting-diode and a first photo-detector thereby facilitating communication of data between the first light-emitting diode and first photo-detector and preventing communication of data between the second light-emitting diode and second photo-detector, and a second position whereat the aperture is aligned with the second light-emitting diode and the second photo-detector thereby facilitating communication of data between the second light-emitting diode and second photo-detector and preventing communication of data between the first light-emitting diode and first photo-detector.

In a further aspect, the invention resides in a method of switching data, the method including:-

25 providing one or more data transmitters for transmitting data;

providing two or more data receivers for receiving the data;

30 emitting data from the one or more data transmitters; and

selectively preventing reception by one or more of the two or more data receivers.

#### BRIEF DESCRIPTION OF DRAWINGS

35

In order that this invention may be more easily understood and put into practical effect, reference will now be made to the accompanying drawings which illustrate

preferred embodiments of the invention, wherein:-

FIGS 1A & 1B are a pair of schematic illustrations of a first embodiment of a data switch;

FIG 2 is a schematic illustration of a second  
5 embodiment of a data switch;

FIG 3 is a schematic illustration of a third embodiment of a data switch;

FIG 4 is a schematic illustration of a fourth embodiment of a data switch;

FIG 5 is a schematic illustration of a fifth  
10 embodiment of a data switch;

FIG 6 is a schematic illustration of a sixth embodiment of a data switch.

15 BEST MODE

With reference firstly to FIGS 1A and 1B there is shown a first embodiment of a data switch according to the invention.

20 This embodiment includes a pair of light-emitting diodes together with a complementary pair of photo-detectors.

An apertured shield is disposed between the respective light-emitting diodes and photo-detectors and  
25 can be moved from a first position (FIG 1A) in which the aperture is aligned with a first light-emitting diode and first photo-detector, and a second position (FIG 1B) in which the aperture is aligned with the second light-emitting diode and second photo-detector.

30 The optical data switch according to FIGS 1A and 1B provides a mechanism to securely route data to one (and only one) of two or more possible destinations. As will be understood from the foregoing, the optical data switch uses a mechanical shutter to select the destination of  
35 the data.

Data, in the form of electrical signals, is sent simultaneously to the two light-emitting diodes. As shown, these two light-emitting diodes are arranged to be



adjacent to two photo-detectors, which convert the light back to electrical signals to be transmitted to two different destinations.

As will be readily apparent, the shutter must be substantially impermeable to light. The shutter is designed so that it can be physically moved to allow light, and hence the data, to be selectively transmitted to either one of the two photo-detectors.

The data switch according to the first embodiment of the invention is extremely simple and has only one (non-electrical) moving part.

The data switch has application in security devices, where the operator must be absolutely certain that the data is being transmitted to the intended destination, and not the wrong (or both) destinations. Because of its construction, it can easily be shown that data can only be transmitted to a single destination at any one time, because the transmission of data depends on the position of the single aperture. That destination can be confirmed by noting the physical position of the shutter.

Unlike conventional electrical switches, there are no failure modes of this switch which would result in a compromise of the security of the data. An additional feature of this switch is that, due to the arrangement of the switch and the optical isolation provided, the two destinations can never be connected together either accidentally or otherwise.

The direction of the flow of data can, of course, be reversed provided the light-emitting diodes and photo-detectors are swapped. In such an arrangement, the data can be selectively sourced from (rather than directed to) either of the independent systems.

Referring now to FIG 2, there is shown a second embodiment of a data switch according to the invention. In this arrangement there is a single transmitter and a pair of receivers (receiver A and receiver B).

In this embodiment, the reception prevention means takes the form an integral pair of plates which are

vertically spaced, one above the transmitter and one below.

Each plate includes an aperture, with the aperture in the lower plate being offset to the left with respect  
5 to the aperture in the upper plate.

As with the previous embodiment, the reception prevention means can be moved between a first position and a second position. As shown in FIG 2, receiver A can receive data transmitted by the transmitter, whilst the  
10 reception of receiver B is blocked by the lower plate.

In the alternative position (which is not illustrated) the reception prevention means is moved to the right relative to the transmitter so that the aperture in the lower plate aligns with the transmitter  
15 and receiver B. In this alternative arrangement, transmission to receiver B is enabled whilst reception by receiver A is prevented by the upper plate.

Turning now to FIG 3, there is now shown a third embodiment of a data switch according to the invention.  
20 In this embodiment, the reception prevention means takes the form of an arcuate shield which almost entirely encompasses the transmitter. The shield can be pivoted about an axis coincident with the transmitter between a first position (illustrated) in which the aperture is  
25 aligned with receiver B and the reception of receiver A is blocked, and a second position (not illustrated) in which the aperture is aligned with receiver A and the reception of receiver B is blocked.

Referring now to FIG 4, there is illustrated a  
30 fourth embodiment of a data switch. This embodiment differs from the previous embodiments in that the shield is fixed and the single data transmitter is mobile between two positions. In the first position (full line), the data transmitter communicates with data  
35 receiver A. In the second position (broken line), the data transmitter communicates with data receiver B. The shape of the shield ensures that both receivers can never simultaneously receive data from the transmitter.

Turning now to FIG 5, there is illustrated a fifth embodiment of a data switch. In this embodiment the data transmitter has been chosen or treated so that the data is only emitted in a forward direction from the transmitter (ie. the transmitter is no longer omni-directional, but rather emits a directional beam of data).

The directional nature of the data emission allows the system to operate without a separate shielding means. Rather, the "shield" is effectively integral with the transmitter and the transmitter is simply "pointed" at the intended receiver thereby excluding the non-intended receiver.

Referring finally to FIG 6, there is illustrated a sixth embodiment which has similarities to the first embodiment in that there are again two transmitters. In the sixth embodiment, the shield takes the form of a bar which is rotatable about its own longitudinal axis. The bar includes two through-holes, each through hole being orthogonal to the longitudinal axis of the bar, and furthermore each through-hole is orthogonal to the other through-hole.

As illustrated, the through-hole shown in broken line enables communication between transmitter A and receiver A. The bar can be rotated (in either direction) through 90 degrees about its longitudinal axis to facilitate communication between transmitter B and receiver B.

It will of course be realised that whilst the above has been given by way of an illustrative example of this invention, all such and other modifications and variations hereto, as would be apparent to persons skilled in the art, are deemed to fall within the broad scope and ambit of this invention as is herein set forth.

## THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. A method of switching data, the method including  
5 selectively allowing and/or preventing communication  
between one or more data transmitters and one or more  
data receivers.
2. A data switch including:-  
10 one or more data transmitters;  
two or more data receivers;  
wherein, in a first configuration of the data  
switch, a first data receiver receives data, and wherein,  
in a second configuration of the data switch, a second  
15 data receiver receives data.
3. A data switch as claimed in claim 2, wherein the data  
switch is configured such that the two or more data  
receivers cannot simultaneously receive data.
- 20 4. A data switch including:-  
one or more data transmitters;  
two or more data receivers;  
one or more reception prevention means adapted to  
25 selectively prevent reception by at least one of the at  
least two data receivers.
5. A data switch as claimed in claim 4, wherein the one  
or more data transmitters are light-emitting diodes and  
30 the two or more data receivers are photo-detectors, and  
each of the one or more reception prevention means is a  
light impermeable shield which is, in operation,  
interposed between a light-emitting diode and a photo-  
detector.
- 35 6. A data switch as claimed in claim 5, wherein the  
light impermeable shield is configured such that the two  
or more data receivers cannot simultaneously receive

data.

7. A data switch as claimed in claim 4, wherein each of the one or more reception prevention means is movable between a first position whereat it prevents reception by a first data receiver, and a second position whereat it prevents reception by a second data receiver.

8. A data switch including:-

a pair of light-emitting diodes electrically connected to a common electrical input, each light-emitting diode adapted to convert an electrical signal from the common electrical input to light;

a photo-detector associated with each light-emitting diode for a re-converting light emitted by an associated light-emitting diode to an electrical signal;

an apertured shutter disposed between the respective light-emitting diodes and photo-detectors, the apertured shutter being movable between a first indexed position whereat the aperture is aligned with a first light emitting-diode and a first photo-detector thereby facilitating communication of data between the first light-emitting diode and first photo-detector, and a second position whereat the aperture is aligned with the second light-emitting diode and the second photo-detector thereby facilitating communication of data between the second light-emitting diode and second photo-detector and preventing communication of data between the first light-emitting diode and first photo-detector.

9. A method of switching data, the method including:-

providing one or more data transmitters for transmitting data;

providing two or more data receivers for receiving the data;

emitting data from the one or more data transmitters; and

selectively preventing reception by one or more of the two or more data receivers.

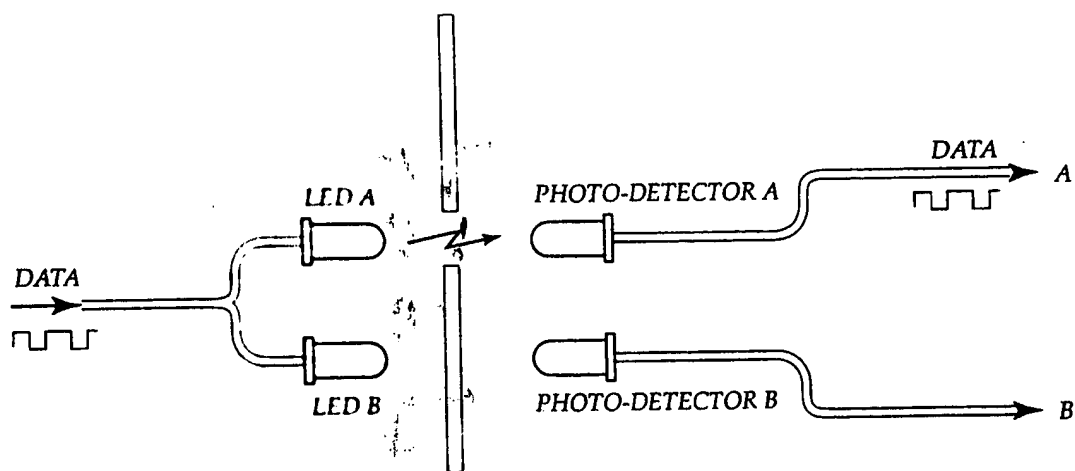


Fig. 1A.

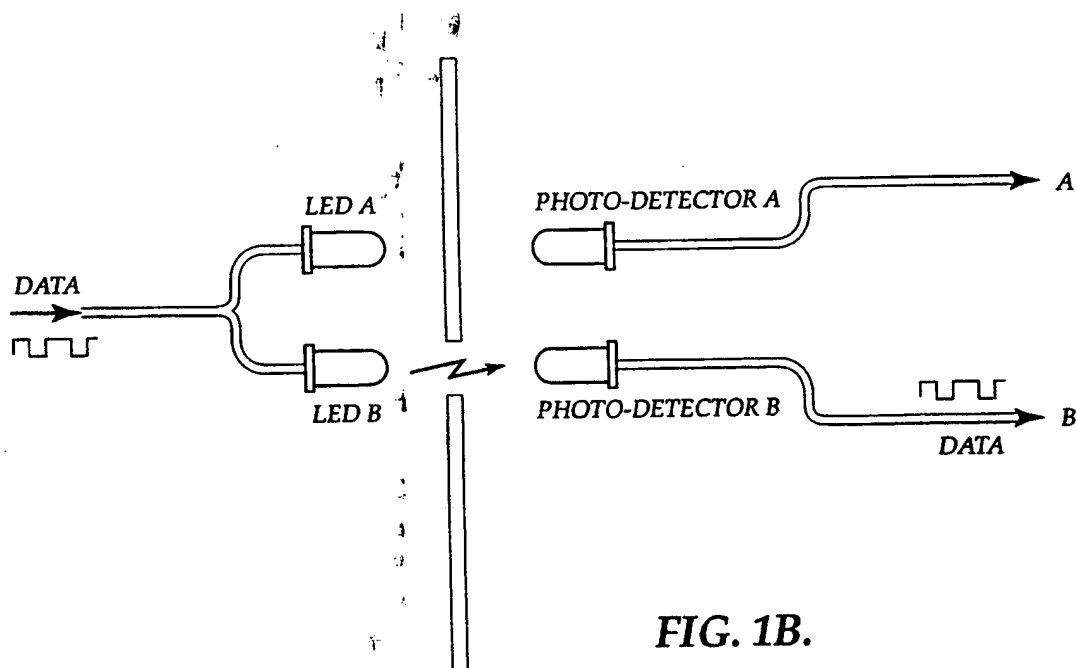
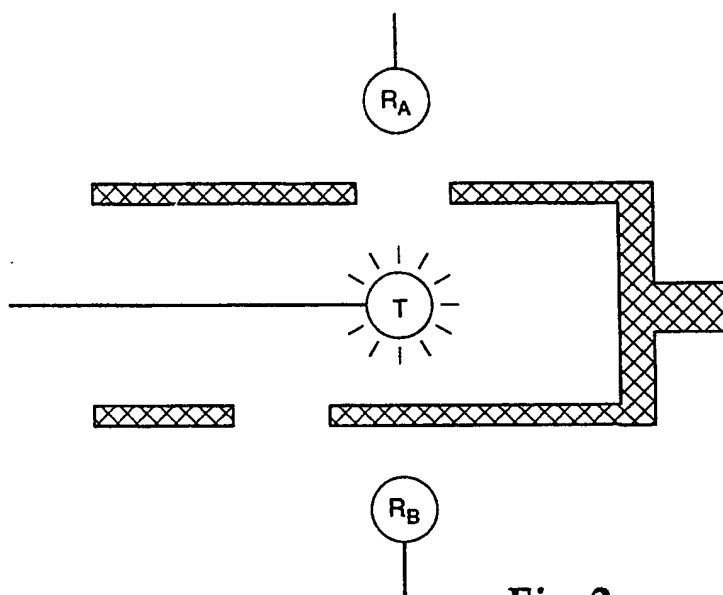
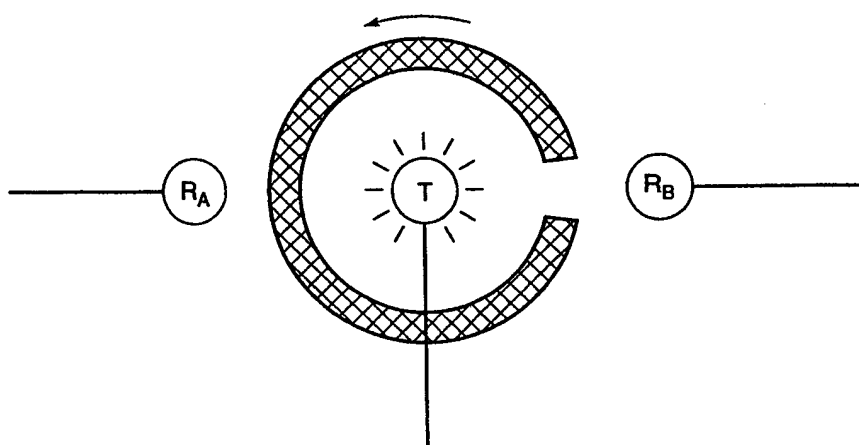
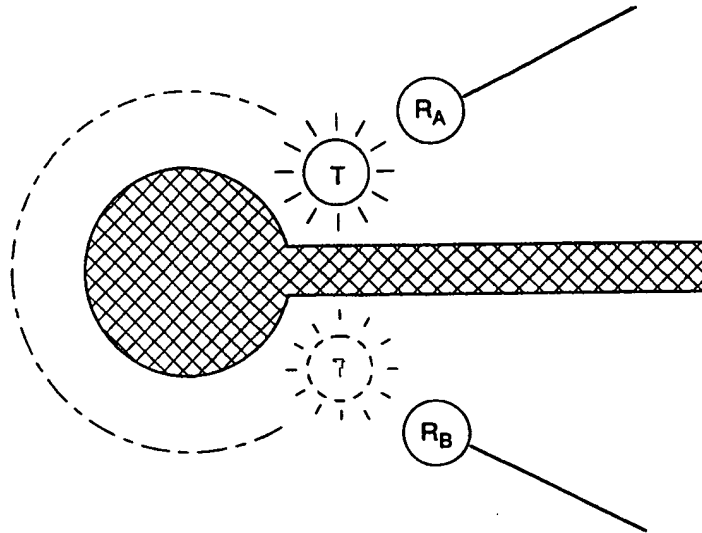


FIG. 1B.

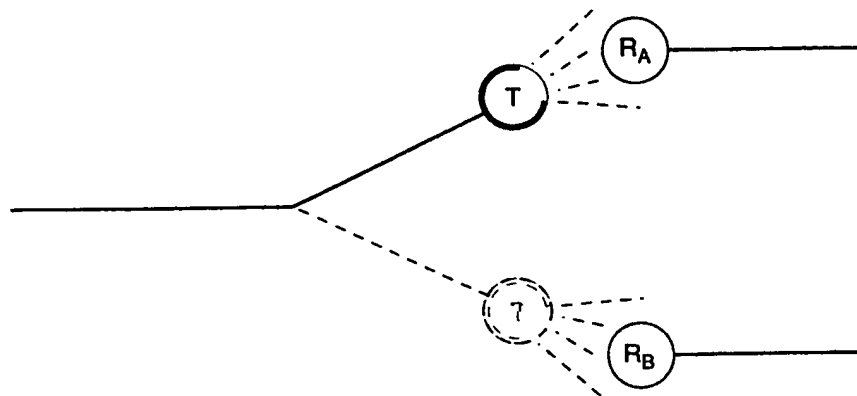
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*Fig. 2.**Fig. 3.*



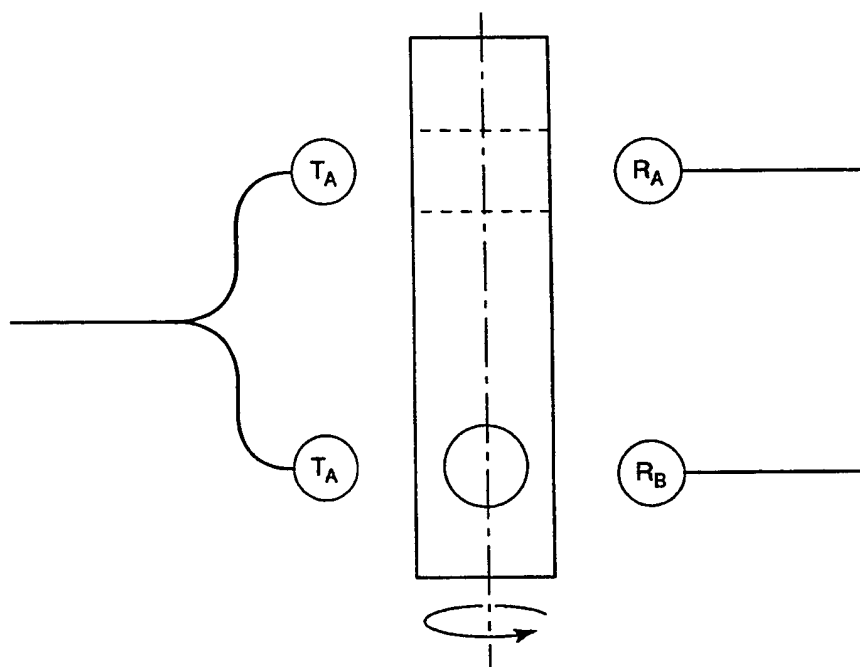


*Fig. 4.*



*Fig. 5.*

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*Fig. 6.*

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/AU 99/00534

<b>A. CLASSIFICATION OF SUBJECT MATTER</b>																						
Int Cl <sup>6</sup> : H04B 10/04, 10 10, 10/24, 10/26; H04J 14/00; G02B 26/08; G06F 3/023																						
According to International Patent Classification (IPC) or to both national classification and IPC																						
<b>B. FIELDS SEARCHED</b>																						
Minimum documentation searched (classification system followed by classification symbols) IPC: as above																						
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<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>																						
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.																				
X	EP 0713297 A (IBM Corp) 22 May 1996 whole document	5, 6, 8																				
X	US 4726646 A (TANAKA et al.) 23 February 1988 whole document	5, 6, 8																				
X	US 4376566 A (BLACKINGTON) 15 March 1983 whole document	5, 6, 8																				
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex																						
<p>* Special categories of cited documents:</p> <table border="0"> <tr> <td>"A"</td> <td>document defining the general state of the art which is not considered to be of particular relevance</td> <td>"T"</td> <td>later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</td> </tr> <tr> <td>"E"</td> <td>earlier application or patent but published on or after the international filing date</td> <td>"X"</td> <td>document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</td> </tr> <tr> <td>"L"</td> <td>document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td> <td>"Y"</td> <td>document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td> </tr> <tr> <td>"O"</td> <td>document referring to an oral disclosure, use, exhibition or other means</td> <td>"&amp;"</td> <td>document member of the same patent family</td> </tr> <tr> <td>"P"</td> <td>document published prior to the international filing date but later than the priority date claimed</td> <td></td> <td></td> </tr> </table>			"A"	document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	"E"	earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family	"P"	document published prior to the international filing date but later than the priority date claimed		
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Date of the actual completion of the international search 14 July 1999		Date of mailing of the international search report 27 JUL 1999																				
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## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/AU 99/00534

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0386772 A (CANON KABUSHIKI KAISHA) 12 September 1990 whole document	5, 6, 8

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 99/00534

## Box I

## Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 1-4; 7, 9  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:  
The above claims are very broad and generic or they include in their scope common data communications switches.
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

## Box II

## Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

## Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/AU 99/00534**

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
EP	713297	JP	8149078				
US	4376566	US	4313226				
EP	386772	JP	2235028	US	5227906	JP	2235029

END OF ANNEX